## CLAIMS

What is claimed is:

1. A system for crystallography comprising:

a sample holder for holding a crystalline sample for characterization of a sample area;

an electron source for generating an electron beam;

a scanning actuator for controlling the relative movement between the electron beam and the crystalline sample, the scanning actuator being controllable for directing the electron beam at a series of spaced apart points within the sample area;

a first processing system for generating crystallographic data based upon electron diffraction from the crystalline sample;

a second processing system configured for determining whether sufficient data have been acquired to characterize the sample area; and

a controller for controlling the scanning actuator to space the points apart such that acquired data is representative of a different grains within the crystalline sample.

2. The system of claim 1, further comprising a third processing system for determining grain sizes in the sample area by counting grain boundaries intersecting concentric circles of spaced apart points.

3. The system of claim 1, further comprising a third processing system for determining grain sizes in the sample area by counting grain boundaries along a series of lines of spaced apart points.

4. The system of claim 1, further comprising a feed-forward loop for providing control parameters, based upon the crystallographic data, to a chemical-mechanical polishing station.

5. The system of claim 1, further comprising a feedback loop for providing control parameters to a deposition station based upon the crystallographic data.

6. The system of claim 1, wherein the electron beam is positioned to intercept the sample at an angle of approximately 20 degrees.

7. The system of claim 1, further comprising a crystalline standard for providing a eference to the processing system.

8. A system for inline crystallographic metrology comprising:

a sample holder for holding a crystalline sample;

a first ion source for generating a first ion beam;

a scanning actuator for controlling the relative movement between the first ion beam and he crystalline sample, the scanning actuator being controllable for directing the first ion beam it desired areas of the crystalline sample;

an electron detector for detecting secondary electrons emitted from the crystalline sample;

a first processing system for creating a contrast intensity image based upon secondary electron emissions from the crystalline sample;

a second processing system programmed to provide crystallographic information based on the contrast image intensity data; and

a controller for controlling the scanning actuator for scanning the first ion beam.

9. The system of claim 8, further comprising a feed-forward loop for providing control parameters to a chemical-mechanical polishing station based upon acquired data.

10. The system of claim 8, further comprising a feedback loop for providing control parameters to a deposition station based upon acquired data.

11. The system of claim 8, wherein the first ion beam is positioned to intercept the crystalline sample at an angle of approximately 90 degrees.

12. The system of claim 8, further comprising a crystalline standard for providing a reference to the processing system.

13. The system of claim 8, further comprising a second ion source for generating a second ion beam, the second ion source controllable by the scanning actuator.

14. The system of claim 13, wherein the second ion beam is positioned to intercept the crystalline sample at angle of between 0 degrees and 90 degrees.

15. A system for inline crystallographic metrology comprising:

a sample holder for holding a crystalline sample;

a first ion source for generating a first ion beam;

an electron source for generating an electron beam;

a scanning actuator for controlling the relative movement between the first ion beam, the electron beam, and the crystalline sample, the scanning actuator being controllable for directing the first ion beam at desired areas of the crystalline sample and for directing the electron beam at a series of points within the sample area;

an electron detector for detecting secondary electron emissions from the crystalline sample;

a first processing system for creating a contrast intensity image based upon secondary electron emissions from the crystalline sample and generating crystallographic data based upon electron diffraction from the crystalline sample;

a second processing system programmed to provide crystallographic information based on the contrast image intensity data and configured for determining whether sufficient data have been acquired to characterize the sample area; and

a controller for controlling the scanning actuator to direct the first ion beam at desired areas such that each ion channeling image is representative of channeling directions within the crystalline sample and to space the points apart such that acquired data is representative of a different grains within the crystalline sample.

16. The system of claim 15, further comprising a feed-forward loop for providing control parameters to a chemical-mechanical polishing station based upon acquired data.

17. The system of claim 15, further comprising a feedback loop for providing control parameters to a deposition station based upon acquired data.

18. The system of claim 16, wherein the electron beam is positioned to intercept the sample at an angle of approximately 20 degrees.

19. The system of claim 16, further comprising a crystalline standard for providing a electron diffraction reference to the processing system.

20. The system of claim 16, further comprising a crystalline standard for providing an

ion channeling reference to the processing system.

22. The system of claim 16, wherein the ion beam is positioned to intercept the crystalline sample at an angle of approximately 90 degrees.

23. A crystallographic standard comprising crystalline orientations in a primary channeling direction and a primary de-channeling direction for establishing a contrast setting for ion channeling analysis of crystalline sample.

24. A crystallographic standard for ion channeling analysis of a crystalline sample having a first primary channeling direction and a second primary channeling direction, the standard comprising a bicrystal having respective boundary rotation angles defined by the first primary channeling direction and the second primary channeling direction.

25. A crystallographic standard for ion channeling analysis of a crystalline sample comprising a plurality of different fiber texture components for setting pass/fail rotation allowances.

26. A crystallographic standard for ion channeling analysis of a crystalline sample comprising a plurality of different fiber texture components for setting pass/fail rotation allowances.

27. A crystallographic standard for off axis ion channeling analysis of a crystalline sample comprising a common axial crystal direction.

28. The crystallographic standard of claim 27, further comprising a random rolling component.

29. The crystallographic standard of claim 27, further comprising a fixed rolling component.

30. A method for determining crystallography of bulk crystal sample comprising:

providing a sample holder for holding a crystalline sample for characterization of a sample area;

generating an electron beam;

controlling the relative movement between the electron beam and the crystalline sample to direct the electron beam at a series of spaced apart points within the sample area;

generating crystallographic data based upon electron diffraction from the crystalline sample;

determining whether sufficient data have been acquired to characterize the sample area; and

spacing the points apart such that acquired data is representative of a different grain within the crystalline sample.

31. The method of claim 30, further comprising determining grain sizes in the sample area by counting grain boundaries intersecting concentric circles of spaced apart points.

32. The system of claim 30, further comprising determining grain sizes in the sample area by counting grain boundaries along a series of lines of spaced apart points.

33. The system of claim 30, further comprising providing feed-forward control parameters, based upon the crystallographic data, to a chemical-mechanical polishing station.

34. The method of claim 30, further comprising controlling polarity of a chemical-mechanical polishing slurry to modify relative material removal rates from different crystalline planes of a crystalline sample to allow consistent endpoint prediction of the chemical-mechanical polishing process.

35. The method of claim 30, further comprising providing feedback control parameters to a deposition process based upon the acquired data.

36. The method of claim 30, further comprising positioning the electron beam to intercept the sample at an angle of approximately 20 degrees.

37. The method of claim 30, further comprising setting data processing parameters based on a crystallographic standard.

38. A method for determining crystallography of bulk crystal sample comprising:
providing a sample holder for holding a crystalline sample;

generating a first ion beam;

controlling the relative movement between the first ion beam and the crystalline sample, for directing the first ion beam at desired areas of the crystalline sample;

detecting secondary electrons emitted from the crystalline sample;

creating a contrast intensity image based upon secondary electron emissions from the crystalline sample;

providing crystallographic information based on the contrast image intensity data; and

controlling the scanning actuator for scanning the first ion beam.

39. The method of claim 38, further comprising providing control parameters, based upon processed emission data, to a chemical-mechanical polishing process.

40. The method of claim 39, further comprising controlling polarity of a chemical-mechanical polishing slurry to modify relative material removal rates from different crystalline planes of a crystalline sample to allow consistent endpoint prediction of the chemical-mechanical polishing process.

41. The method of claim 38, further comprising providing control parameters, based upon processed emission data, to a deposition process.

42. The method of claim 38, further comprising positioning the first ion beam to intercept the crystalline sample at an angle of approximately 90 degrees.

43. The method of claim 38, further comprising directing the first ion beam at desired areas of the crystalline sample in a desired direction such that processed emission data is representative of channeling directions within the crystalline sample.

44. The method of claim 43, further comprising rotating the sample about an axis of the incident first ion beam to align the first ion beam with a channeling direction of the sample.

45. The method of claim 38, further comprising setting emission data processing parameters based on a crystallographic standard.

46. The method of claim 38, further comprising providing a second ion source for generating a second ion beam.

47. The method of claim 46, further comprising positioning the second ion beam to intercept the crystalline sample at angle of between 0 degrees and 90 degrees.

48. The method of claim 46, further comprising determining a reference contrast setting by:

rotating the crystalline sample about the longitudinal axis of the first ion beam;

collecting a series of contrast intensity images generated by the first and second ion beams; and

comparing the collected contrast intensity images to reconstruct the crystallography of the crystalline sample.

49. The method of claim 38, further comprising using crystallographic information to determine crystallographic parameters of the bulk crystal sample selected from the group consisting of single fiber texture strength, dual fiber texture strength, area fraction, area fraction versus. depth through a film, reconstruction of CMP removal rate curves *from orientation data*, and crystallographic changes versus depth profile.

50. A method for determining crystallography of bulk crystal sample comprising:

providing a sample holder for holding a crystalline sample;

generating a first ion beam;

generating an electron beam;

controlling the relative movement between the first ion beam, the electron beam, and the crystalline sample for directing the first ion beam at desired areas of the crystalline sample and for directing the electron beam at a series of points within the sample area;

detecting secondary electron emissions from the crystalline sample;

creating a contrast intensity image based upon secondary electron emissions from the crystalline sample and generating crystallographic data based upon electron diffraction from the crystalline sample;

providing crystallographic information based on the contrast image intensity data and configured for determining whether sufficient data have been acquired to characterize the sample area; and

controlling the scanning actuator to direct the first ion beam at desired areas such that each ion channeling image is representative of channeling directions within the crystalline sample and spacing the points apart such that acquired data is representative of a different grains within the crystalline sample.

51. The method of claim 50, further comprising spacing the points apart sufficient distances such that diffraction data received from the points emanates from different grains of the crystalline sample.

52. The method of claim 50, further comprising directing the first ion beam at desired areas of the crystalline sample in a desired direction such that emission data is representative of channeling directions within the crystalline sample.

53. The method of claim 52, further comprising rotating the sample about an axis of the incident first ion beam to align the first ion beam with a channeling direction of the sample.

54. The method of claim 50, further comprising providing control parameters, based upon processed emission data and diffraction data, to a chemical-mechanical polishing process.

55. The method of claim 54, further comprising controlling polarity of a chemical-mechanical polishing slurry to modify relative material removal rates from different crystalline planes of a crystalline sample to allow consistent endpoint prediction of the chemical-mechanical polishing process.

56. The method of claim 50, further comprising providing control parameters, based upon processed emission data and diffraction data, to a deposition process.

57. The method of claim 50, further comprising positioning the electron beam to intercept the sample at an angle of approximately 20 degrees.

58. The method of claim 50, further comprising further comprising setting data processing parameters based on a crystallographic standard.

59. The method of claim 50, further comprising positioning the first ion beam to intercept the crystalline sample at an angle of approximately 90 degrees.

60. The method of claim 50, further comprising using crystallographic information to determine crystallographic parameters of the bulk crystal sample selected from the group consisting of single fiber texture strength, dual fiber texture strength, area fraction, area fraction versus depth through a film, reconstruction of CMP removal rate curves from orientation data, and crystallographic changes versus depth profile.